1   **Use of a Job Ticket as a Generic XML Database**

2   **Technical Field**

3   The technical field is the integration and control of services in a networked environment.

4   **Background**

5   Services may be provided by one or more operating units in a computer-based network.

6   Users of the network may generate specific tasks and send the tasks into the network to be

7   assigned to one of the operating units. For example, a user at a computer terminal may generate

8   a printing order using a printer driver installed on the terminal. The printer driver is used to control

9   the printing request. In another example, a user at a computer terminal may generate a printing

10 order and send the printing order into a computer network so that the printing order is completed

11 by a printing service. The printing order may be related to a company brochure. The printing order

12 may contain unique requirements such as paper type, font size, layout, graphics, color, and other

13 requirements. The user may specify that a specific printing service, such as Kinkos, prepare the

14 company brochure. Alternatively, the computer network may include programs that suggest

15 printing services to the user.

16   To control the printing job, the user's computer terminal may generate a job ticket. The

17 job ticket includes the requirements, such as the requirements listed above, and an identification of

18 the specific job that allows the job status to be tracked through the computer network.

19   Use of the job ticket allows printing and similar services to be allocated to those resources

20 (i.e., the operating units) that are best suited to completing the services. Unfortunately, current

21 computer systems do not allow access to the wide variety of services existing in networked

22 computer systems, such as the Internet. In addition, current systems require users to have some

23 knowledge of the existing resources, and may require users to include applicable programming to

24 communicate with the services. Furthermore, current systems do not allow a job request to be split

25 among several processors. As a result, completion of the job request may take longer than

26 necessary, and may not be completed in the most efficient, lowest-cost manner.

27 **Summary**

28   To overcome these and other problems related to use of a job ticket, a method and an

29 apparatus allow a client to manage job attributes and processes using an electronic service center.

30 The service center includes a job ticket service that allows access and modification of a job ticket

1   by multiple users on a network. The method and apparatus use a network-accessible job ticket

2   to relate to a specific job or content. The job ticket may be an object, such as an XML object,

3   comprising routines and data. The content may be stored on the network and may be accessed

4   by multiple job tickets. Storage and management of the job ticket are transparent to the user. The

5   job ticket is stored in a common location in the network. The job ticket remains in the same

6   location in the network, and users access only that portion of the job ticket required to complete

7   a designated process. Security measures may be added to limit access to those users designated

8   as being allowed to access the job ticket and the job file. The job ticket may include a service ID

9   that relates the job ticket back to the originating job ticket service. In this way, a user who acquires

10   all or part of the job ticket can refer back to the originating job ticket service (and the original, or

11   as-modified, job ticket) to verify any changes and to ensure that the job ticket being accessed is

12   up-to-date. The job ticket also includes a job ID to refer the job ticket to a specific job.

13   The service center is coupled through a communications network to a front end service.

14   The front end service allows a user to generate a service or job request. The communications

15   network may be the Internet, or a local area network, for example.

16   The service center includes a service bus, to which are coupled a job store, the job ticket

17   service, and a work flow controller. Also coupled to the service center are one or more processors

18   that may be controlled to complete processes and tasks defined in the job tickets.

19   The job ticket service may generate and store the job tickets. Job content (e.g., a PDF file)

20   is stored in the job store. With this structure, the user does not have to manage storage of the job

21   content or to know which job store holds the job content. The job ticket service controls access

22   to the job tickets, and, through the use of the job tickets, also controls access to job content in the

23   job store, or elsewhere in the network. The job ticket service may create a reference to the job

24   ticket, and may use the reference to control access to the job ticket.

25   The use of job tickets allows clients to define databases, and to store data though the job

26   ticket service. The databases may be used to hold contact lists, addresses, and other personal

27   data. The databases may also be used to store any other generic data. The databases could then

28   be used in conjunction with a variety of e-services provided by the processors. For example, an

29   e-mail processor that provides e-mail services may be used in conjunction with a personal contact

30   list to send e-mail messages, transfer electronic files, or to establish a chat room. The e-mail

1   processor may access the contact list at predefined intervals to send e-mail messages to a select

2   group of e-mail addressees. Furthermore, because the service center provides a single portal to

3   processors that are coupled to the communications network, the client need not have any

4   knowledge of the database structure, or the processing requirements of the processors.

5   In an embodiment, the job ticket may be used as a generic database in conjunction with

6   an e-mail service. A client may have established a list of e-mail contacts. The contacts database

7   may then be stored in the job store. A corresponding job ticket may be stored at the job ticket

8   service. The job ticket includes control data needed to send and receive e-mail through the service

9   center. In an embodiment, the generic database may be an XML or HTML database, or any other

10 markup language database. The database may also be a structured query language (SQL)

11 database.

12   The use of the job ticket also allows for parsing, searching and updating the contacts

13 database. For example, the client may desire to search the contacts database for phone numbers

14 by name. This search functionality is included in the job ticket, and allows the job ticket service to

15 provide the client with a list of phone numbers for all entries in the contacts database by name.

16 **Description of the Drawings**

17   The detailed description will refer to the following figures in which like numeral refer to like

18 items, and in which:

19   Figure 1 is a block diagram showing a prior art use of a job ticket;

20   Figure 2 is a tree diagram showing the processes in an example job ticket;

21   Figure 3 is a block diagram of a digital image work flow network;

22   Figure 4 is a block diagram of a service center used with the network of Figure 3;

23   Figures 5A-5D illustrate an exemplary job ticket;

24   Figure 6 is a diagram of functions controlled by a job ticket service;

25   Figure 7 is a diagram showing access functions controlled by the job ticket service;

26   Figure 8 is a block diagram illustrating additional control features of the job ticket service;

27   Figure 9 is a flow chart illustrating one of the processes controlled by the job ticket service;

28 and

29   Figures 10-16 are flow charts showing sub-processes in the overall process illustrated in

30 Figure 9.

1 **Detailed Description**

2   Figure 1 is a block diagram showing a prior art application of a job ticket service. Job

3 tickets are often associated with a printing standard, the job definition format (JDF). The JDF is

4 described in detail in JDF Specification Draft Spiral 4.0, available at www.hp_opensource.com,

5 which is hereby incorporated by reference. In Figure 1, a user 1 generates a job request and sends

6 the job request through a portal 4 to a processor 5. The job request may include a job ticket data

7 file 2 and a content file 3. The user 1 may be a computer terminal in a networked computer system

8 and the processor 5 may be a networked printer. The job request may involve printing a

9 document. The document may be represented by the content 3, which is a digital representation

10 of text and images to be printed. The intended format of the printed document may be described

11 in the job ticket file 2, which is simply a digital file that specifies how the printer is to print the

12 document. For example, the job ticket file 2 may require that the document be printed on back-to-

13 back pages.

14   In a specific application, the functions of the job ticket file 2 may be carried out by a printer

15 driver. The printer driver encodes control data related to printing the document, and sends the

16 control data and the content 3 to the printer (i.e., the processor 5). The printer accesses the control

17 data and the content 3 to print the document.

18   While the application shown in Figure 1 works well to print a document, the application has

19 many drawbacks. In particular, if multiple processors are involved in producing the document,

20 each such processor will require access to the job ticket file 2. This access brings problems related

21 to security, modification control and workflow control. For example, each processor requiring

22 access to the job ticket file 2 may have to wait on processing until a prior processor has completed

23 use of the job ticket file 2. Thus, the prior art application may result in unwanted delays in

24 completing the job request.

25   Prior art applications of job ticket services also suffer because the user may not know

26 anything about the processors, including capabilities and availabilities of the processors, or even if

27 the processors exist. Thus, the user may not know which portal to use to connect to a specific

28 processor.

29   These and other problems are solved by a method and an apparatus that controls access

30 to a job ticket and associated content through use of a job ticket service. The job ticket service

1 includes mechanisms that arbitrate access to the job ticket among multiple users of the job ticket,

2 limit access to the job ticket by incorporating security features, and ensure modifications made by

3 one processor or user are reflected in the job ticket and the content. In effect, the apparatus

4 includes a generic database that couples input data from clients as job requests with output services

5 such as processors that perform tasks or processes to complete the job requests. The database

6 may have has the features of a generic XML database in that it is extensible, and in that the clients

7 need not have any knowledge of the individual processes to be performed, or the internal

8 programming requirements of the processors. Thus, the clients may submit job requests to a

9 service center that will ensure that an appropriate processor or processors are assigned to complete

10 the job request. Other database formats may also be used.

11 Before describing the apparatus and method in detail, a review of a job ticket is provided.

12 Figure 2 is a node-tree diagram (or simply a node tree) 10 that illustrates processes defined in a

13 job ticket for printing a brochure. The brochure may be printed on a commercial press, and may

14 use digital content to generate plates for printing the brochure. Within the node tree 10, the nodes

15 specify a product, process, or group of processes. Each node may modify, consume or create

16 resources. Each node may contain further nested nodes, or sub-nodes. The arrangement of nodes

17 and sub-nodes may be likened to a tree, and each node and sub-node may be referred to as a

18 branch. A brochure node 11 defines the features and parameters of the brochure. A cover node

19 12 defines the parameters for producing the brochure cover. Inside pages node 13 includes the

20 parameters to produce the inside pages. The inside pages node 13 is shown with several sub-

21 nodes, including a sub-node 14 for digital plate making. The digital plate making sub-node 14 itself

22 includes two additional sub-nodes, a ripping sub-node 16 and a plate making sub-node 18.

23 Each of the nodes and sub-nodes shown in Figure 2 has associated with it input resources

24 and at least one output resource. A resource may be described by parameters or logical entities.

25 The resource may be a physical entity such as a component, a handling resource, or a consumable.

26 A component resource may be the output of a node or sub-node, such as a printed sheets. A

27 handling resource is used during a process, but is not consumed by the process. A consumable

28 resource may be partly or wholly consumed by the process. Examples of consumable resources

29 include inks, plates, and glue. Other resources may be a digital file or representation of a physical

30 object. For example, the ripping sub-node 16 may include as input resources a run list, media, RIP

1 parameters, and layout. The run list resource describes the pages, including the files in which the

2 pages occur, and which pages are to be used. The media resource describes the media that will

3 be used to make plates, and is needed to describe the dimensions of the media. The RIP

4 parameters resource describes all device-specific parameters of the ripping process. The layout

5 resource describes placement of source pages onto the plates, and eventually onto press sheets.

6 As an output resource, the ripping sub-node 16 may provide ripped flats. Other resources include

7 parameter resources, which define the details of processes, as well as other non-physical computer

8 files used by a process.

9 The node tree 10 shown in Figure 2 is intended to apply to printing a document. However,

10 node-tree diagrams may be used to represent job tickets for other services besides printing. For

11 example, a job ticket may be used for data processing, image processing, creating and maintaining

12 a database, electronic publishing, e-mail, and various e-commerce services. Moreover, the job

13 ticket may be used to allow different e-commerce services to interact with each other.

14 Figure 3 is a block diagram of a digital imaging work flow (DIW) network 20 that

15 incorporates a service center and a job ticket service to control tasks submitted by clients. The

16 service center may operate as a single portal through which the clients connect to one or more e-

17 services including e-mail, e-commerce and online shopping, e-printing, and data services, including

18 database searching and database construction, population and maintenance. Using a single portal,

19 such as the service center, allows the clients to select from a wide variety of e-services, such as

20 those noted above, without requiring the clients to have any prior knowledge of the e-services.

21 The service center may include components that receive information in the form of job

22 requests, and using the information, create a job ticket that specifies tasks and resources. The job

23 ticket may be stored in a job ticket service, and notices may be posted to indicate when a job ticket

24 is available. Processors coupled to the service center may bid on completion of the job ticket, and

25 the service center may include a bidding service that evaluates bids. The service center may select

26 one or more processors to assign to the job ticket based on client-supplied criteria, or based on

27 a set of standard criteria, including industry standard criteria. The service center may provide

28 mechanisms to control access to the job ticket, or to portions (branches) of the job ticket. The

29 mechanisms include branch locking, and authorization and authentication servers that use public key

30 encryption, or similar processes.

1   The service center may include hardware components such as servers, computers, central

2   processing units, communications interfaces, and memory devices to provide the processing

3   capability and data storage required to carry out the above-described functions.

4   The DIW network 20 includes a front end service 30 that allows a client 31 to generate

5   and submit a service or job request. In an embodiment, the front end service 30 may be an Internet

6   web browser. Alternatively, the front end service 30 may be a web application or a port monitor.

7   The job request may contain detailed information about how the job is to be executed, and may

8   be formatted according to the job definition format standard. Alternatively, the job request may

9   include only basic information, which will be used by another component to finalize the job

10   definition, or work flow. Finally, the job request may include the content, or job, that is to be

11   processed. The content could be one or more digital files, text files, and other files. The front end

12   service 30 is coupled to a communications network 35, which may be the Internet or a local area

13   network, for example. Coupled to the communications network 35 is a service center 40 that links

14   one or more processors 80_i to the communications network 35. Each of the processors 80_i may

15   include a cache 81_i that may be used to store information related to a job request, including

16   information related to job tickets. In an embodiment, the service center 40 may be an Internet web

17   site that includes data storage and control functions. In another embodiment, the service center 40

18   is a node in a local area network.

19   The service center 40 allows a broad spectrum of communications between entities coupled

20   to the service center 40. In particular, the service center 40 allows different e-services to interact

21   programmatically with one another using specific protocols and generic protocols (e.g., TCP/IP).

22   This programmatic interaction allows different services and processes that are coupled to the

23   network to exchange data and files, and to modify the data and files. The programmatic interaction

24   may be completed by use of a remote procedure call (RPC) between entities coupled to the service

25   center 40. Other methods for providing the programmatic interaction include CORBA, UDDI, and

26   e-speak.

27   Figure 4 is a diagram of the service center 40. The service center 40 includes a service bus

28   41 in communication with the communications network 35 and the processors 80_i of Figure 3.

29   Coupled to the service bus 41 is a job store 50, a job ticket service 60, a work flow controller 70,

30   an optional bidding service 90, an authorization server 92 and an authentication server 94. The job

1 store 50 may store one or more job content files 51_i. The job ticket service 60 may control one

2 or more job tickets 61_i. The work flow controller 70 may use one or more agents 71_i to control

3 processes on the service bus 41.

4 The job store 50, job ticket service 60 and work flow controller 70 function to accept

5 information from the clients 31, and to use the information to control the actions of the processors

6 80_i. The processors 80_i performs specific tasks or processes as determined by the service center

7 40.

8 The job store 50 may be a node on the service bus 41, and may include programming to

9 allow the job store 50 to carry out its functions. The job store 50 may be used to store the content

10 51, which may be in the form of one or more large files. In the context of printing a document using

11 a service or process coupled to the service bus 41, the job store 50 may store the document

12 content in one or more PDF files, for example. The content 51 may include graphics and text. The

13 content 51 for a specific document may include several files. For example, a brochure may have

14 a separate file for the cover and another file for the inside pages. Text for the inside pages may be

15 in one file and images in yet another file. The content 51 may also include links to other resources

16 or entities on the service bus 41. The job store 50 provides for mass storage of the content 51, so

17 that a user (client 31 or processor 80) does not have to provide the mass storage required for the

18 job content 51. By using the mass storage capabilities of the job store 50, the content 51 may be

19 made to persist in the network 20, and may be made accessible to users at any time. That is, the

20 job store 50 may store the content 51 for an extended time. The job store 50 also manages and

21 controls the content so that the user (client 31 or processor 80) does not have to manage the

22 content 51. Management functions include maintaining configuration or version control of the

23 content 51, controlling access to the content 51, and maintaining the content 51 in storage.

24 The job ticket service 60 holds job tickets 61. The job ticket service 60 controls access

25 to and may manage configuration of the job tickets 61. For example, the job ticket service 60 may

26 allow users (clients 31_i and processors 80_i) to access a portion or branch of a job ticket 61 rather

27 than passing the job ticket 61 among multiple users. Access to the job ticket portion may be

28 effectuated by use of an application programming interface, a scriptable interface, or a similar

29 feature. As noted above, the job ticket 61 does not include the content 51 (e.g., the graphical and

30 text files of a document), but the job ticket 61 relates to content 51 (e.g., a PDF file) stored in the

1   job store 50. The user does not have to manage storage of the job content or to know which job

2   store 50 holds the job content. The job ticket service 60 instead passes a reference in the job

3   ticket 61. This allows multiple clients 31 and processors 80_i to access the content 51.

4   Furthermore, the content 51 may relate to more than one job ticket 61. The job ticket service 60,

5   and its interrelationships with other entities coupled to the service bus 41, will be described later

6   in detail.

7   Some job tickets 61 may be accessed by multiple processors 80, in either serial,

8   overlapping, or simultaneous fashion. The multiple access processing could result in problems with

9   use of the job ticket 61. For example, a first processor may acquire the job ticket 61 (or a portion

10   or branch thereof), and perform a process specified in the work flow, which may modify the

11   branch. Such modification may be to indicate a branch as complete, use up input resources, or

12   create new output resources, for example. A second processor could attempt to acquire the

13   branch, but might not "know" that the first processor had modified the branch. Alternatively, if two

14   processors compete for the same branch, a deadlock situation might occur.

15   One solution to the above problems may be to lock the job ticket 61 whenever a processor

16   80 acquires the job ticket 61. Unfortunately, locking the job ticket 61 may prevent concurrent or

17   parallel processing and may slow down completion of the job request 32.

18   The job ticket service 60 shown in Figure 4 overcomes these and other problems by having

19   the capability to lock the job ticket 61 at the branch level. The branch locking may be

20   accomplished by one of several methods. The work flow controller 70 may assign one or more

21   specific processors 80_i to perform the tasks identified with the branch to be locked. Where only

22   one processor 80 is authorized access to the branch, branch locking may not be required. Where

23   more than one processor 80 is authorized access to the same branch, the job ticket service 60 may

24   lock the branch when one of the authorized processors 80 actually acquire the branch.

25   If the work flow controller 70 has not assigned processors 80_i to branches (i.e., any

26   processor 80 may access a branch at any time), the job ticket service 60 may lock the branch when

27   a processor 80 acquires the branch.

28   The job ticket service 60 may lock the branches by setting a lock/unlock flag for each

29   branch. Processors 80_i accessing the job ticket 61 may then review the lock/unlock flag status to

30   determine if the branch may be accessed. In some circumstances, the job ticket service 60 may

1   allow access only to those branches that are unlocked. A processor 80 that has completed a task

2   defined by the branch may need to have the branch unlocked in order to modify the branch.

3   The work flow controller 70 may be used to create the job tickets 61 that are stored in the

4   job ticket service 60. The work flow controller 70 may review the job requests 32 submitted by

5   the clients 31, and may then use a job ticket template to prepare the job ticket 61. The work flow

6   controller 70 may then send the job ticket 61 to the job ticket service 60 for storage and

7   processing.

8   The work flow controller 70 also controls completion of tasks among the processors 80_i.

9   In an embodiment, the work flow controller 70 determines which of the processors 80 have the

10 necessary and available resources to begin the processes listed in a specific job ticket 61. The

11 work flow controller 70 then designates the appropriate processors 80_i to complete the tasks

12 referenced by the job ticket 61. For example, if a job ticket 61_1 requires color printing, the work

13 flow controller 70 may determine that only processor 80_3 is a color printer with the capacity to

14 begin the job specified in the job ticket 61_1. This embodiment in which the work flow controller

15 70 determines which processors 80_i to assign to a specific job ticket 61 may be especially

16 appropriate when the network 35 is a local area network and all processors 80_i are directly

17 coupled to the local area network 35.

18   Alternatively, the work flow controller 70 may receive bid information from Internet-

19 connected processors 80_i and may use the bid information to select the processors 80_i to complete

20 the job request 32.

21   The work flow controller 70 may also be used to designate the various nodes, input and

22 output resources, and other features of the node tree used to complete the job request. That is, the

23 work flow controller 70 may be used to create a construct, or work flow, such as the node tree

24 10 shown in Figure 2. To accomplish these tasks, the work flow controller 70 may include one or

25 more agents 71_i that write a job definition file, based on control data contained in the job request

26 32. Alternatively, a separate management information system (not shown) may be used to create

27 the nodes, and to control flow of tasks to the processors 80_i and other entities. In yet another

28 embodiment, the job definitions may be written by the client 31 that originated the job request 32.

29   Referring again to the node tree 10 of Figure 2, many output resources of the individual

30 nodes serve as input resources for other nodes. These other nodes may not be able to begin

1 executing until all input resources are complete and available, which means that the nodes may need

2 to execute in a well-defined sequence. For example, a process for making plates will produce

3 press plates as an output resource that is required by a printing process. In the hierarchical

4 organization of the node tree 10, nodes that occur higher in the node tree 10 represent higher-level,

5 more abstract operations, while lower order nodes represent more detailed, specific processes.

6 Moreover, nodes near the top of the node tree 10 may represent only intent regarding the

7 components or assemblies that comprise the product, and lower level nodes provided the detailed

8 instructions to a processor 80 to perform a specific process.

9 Because two node trees may not be similar, the work flow controller 70 may determine

10 processes to be completed, the order in which the processes are completed, and the processors

11 80_i that are to complete the processes. The work flow controller 70 may use the agents 71 to

12 determine an actual work flow, considering factors such as control abilities of the processors 80_i

13 that complete the processes, transport distances between processors 80_i, load capabilities of the

14 processors, and time constrains in the job request, for example. The agents 71 may define the

15 overall process using serial processing, which involves subsequent production and consumption of

16 resources by the processors 80_i, overlapping processing, which involves simultaneous consumption

17 and production of resources by more than one processor 80_i, parallel processing, which involves

18 sharing resources among processors 80, and iterative processing, which involves a back and forth

19 processing scheme to develop resources.

20 Returning to Figure 4, the processors 80_i may be used to provide data services to the

21 clients 31. However, each processor 80 can have a unique interface, data format, query syntax,

22 security protocol, and the like. For example, the processor 80_1 may be configured as a web server

23 and so responds to hypertext transfer protocol (HTTP) request packets and generates responses

24 formatted as hypertext markup language (HTML) web pages. In contrast other processors 80_i

25 may use file transfer protocol (FTP) or other available transfer protocols, both public and private.

26 In a particular example, each of the processors 80_1 - 80_3 implements a database web

27 server that hosts a "website" having a predefined structure and access syntax and protocol. In

28 general each website is designed to provide information about its database content response to

29 queries (job requests) communicated through network 20. Because each processor 80_i may be

30 created and maintained by a separate organization, there is no uniform interface provided for

1 interacting with the various processors 80_i. For example, the databases may relate to customer lists

2 in an e-commerce application, and the processor 80_1 may enable searches by last name, phone

3 number, zip code, or other searchable fields whereas the processor 80_2 may enable searches only

4 by last name. Accordingly, and in the absence of the service center 40, the job requests 32 must

5 differ in content to evoke the desired response from each processor 80_i. Also, the processor 80_1

6 may require that a query be processed through a series of pages before a response is generated.

7 In contrast, the processor 80_2 may allow direct, one-page access to submit queries and generate

8 responses. Hence, the processor 80_1 will require a series of communication packets to be received

9 before the desired response is generated whereas the processor 80_2 is potentially accessed with

10 a single communication packet that encapsulates the desired query data.

11   The service center 40 serves as an interface between the client 31 and the various

12 processors 80_i, and allows the client to submit data queries (job requests) without having any prior

13 knowledge of the database being searched, and its associated search engines.

14   In determining which of the processors 80_i to assign to complete a particular job request,

15 the work flow controller 70 may poll the processors 80_i that are coupled to the service center 40.

16 As noted above, the processors 80_i may be coupled directly to the service bus 41, or may be

17 coupled indirectly through another communications bus, such as the Internet, for example. The

18 polling may occur whenever a job ticket 61 is created by the job ticket service 60. Alternatively,

19 the polling and corresponding information collection may occur on a periodic basis, and the work

20 flow controller 70 may store information related to the processors 80.

21   As an alternative to polling, processors 80_i coupled to the service center 40 may monitor

22 the job ticket service 60. The job ticket service 60 may periodically post, in a bulletin board

23 fashion, for example, notices for job tickets that are available for processing. The processors 80_i

24 may then submit a bid for the tasks and processes defined in the job ticket notice. The work flow

25 controller 70, or the separate, optional bidding service 90, may review the bids, and determine

26 which single processor 80 or combination of processors 80_i would be best suited to complete the

27 tasks and processes defined in the job ticket notice.

28   The service center 40 may include several features to provide security and to control access

29 to the job ticket 61. As discussed above, the job ticket service 60 may include a provision for

30 branch locking. In addition, servers may be used to authorize and authenticate a processor 80 and

1 maintain the authorization and authentication during completion of a job request 32. The

2 authentication server 92 receives authentication information from a processor 80 and the

3 authorization server 94 uses the information to check authorization functionality. The authorization

4 or access rights of the processor 80 may be carried as a part of the job ticket 61. The servers 92

5 and 94 may be hardware devices, but need not exist in the same hardware platform, and the

6 servers 92 and 94 need not be tightly coupled. Alternatively, the functions of the servers 92 and

7 94 may be performed in programming stored in one of the components of the service center 40,

8 such as the work flow controller 70, for example. Using the above-described features, the service

9 center 40 may provide trusted authentication information about the processor 80 to the

10 authorization server 94, and the authorization server 94 then performs its authority check functions.

11   The job ticket 61 may be signed with an industry standard public key encryption message

12 digest (MD) signature, and may be protected by a public key encryption system. Hence, any user

13 that has the public key may validate the job ticket 61 without having to communicate with the

14 authentication server 92. These features reduce communication between distributed server

15 applications. The features also allow the job ticket 61 to be passed from one processor 80 to

16 another processor 80, maintaining security, without communicating with the service center 40.

17   In an alternative embodiment, the job ticket 61 holds authentication/access data, allowing

18 controlled access within the service center 40 infrastructure. Resources may be protected by

19 passwords and other mechanisms. Access to the job ticket 61 may be similarly protected.

20 Furthermore, processors 80_i with access authorization may have such access authorization invoked

21 by listing the processors in the job ticket. The listing may be effectuated by recording a network

22 address for the processors 80_i, for example. The network address may be incorporated in the bid

23 information recorded in the job ticket 61.

24   Although the above description refers to development by the work flow controller 70, other

25 components in the network 20 may be used to develop an overall work flow to complete the job

26 request 32. For example, the job ticket service 60 may be used to develop the overall work flow.

27   As discussed above, the bidding service 90 may be used to receive bid information from

28 processors 80_i coupled to the service center 40. The processors 80_i submit bids in response to

29 posting of job ticket notices at the service center 40. In an embodiment, the job ticket notice is a

30 separate object stored in the service center 40. In another embodiment, the job ticket 61 itself

1   serves the notice function. The work flow controller 70 may post the job ticket notices after receipt

2   of the job request 32. Whether the bidding service 90 or the work flow controller 70 receives the

3   bids, the bid evaluation and selection process may be the same.

4   The job ticket notice posted by the work flow controller 70 may include specific tasks or

5   processes (branches) that must be completed to complete the job request 32 (see Figure 7). A

6   simple job request 32 may have only one branch. More complex job requests 32, such as the job

7   request illustrated in Figure 2 (i.e., print a brochure) may have many branches. Furthermore, some

8   branches may be so interrelated that they can only be completed in a specific sequence, while other

9   branches can be completed in a parallel or an overlapping fashion. This interrelationship may often

10   be the result of one branch producing an output resource that is an input resource for one or more

11   other branches. The job ticket notice may include descriptions of specific branches and their

12   interrelationships in sufficient detail to allow the processors 80_i to bid for completion of the

13   branches. The job ticket notice may persist in the service center 40 for a specified time to allow

14   the processors 80_i to send bids. The time may be a set value (e.g., one hour) or may be based on

15   a completion deadline specified in the job request 32.

16   The bidding service 90 may select bids 91 from the processors 80_i based on set criteria.

17   For example, the job request 32 may specify minimum performance requirements (e.g., a maximum

18   cost and a completion deadline). The bidding service 90 may reject any bids that fail to satisfy the

19   minimum performance requirements. Where the work flow controller 70 has established multiple

20   branches, each such branch may include minimum performance requirements. The branch-specific

21   performance requirements may be established by the work flow controller 70 based on overall

22   performance requirements for the job ticket 61. A processor 80 that bids on a particular branch

23   may be rejected by the bidding service 90 if the processor 80 fails to meet the minimum

24   performance requirements.

25   If the client 31 does not specify any minimum performance requirements, the bidding

26   service 90 may apply a standard set of criteria (e.g., an industry standard). In addition, the bid

27   must satisfy any requirements for producing output resources. In this way, bids that are made in

28   error, or that would otherwise likely be rejected, can be screened out. For example, a bid for

29   printing inside pages of the brochure may indicate a one year completion date. Such a bid may be

30   rejected, even in the absence of any specified performance requirements from the client 31.

1   In addition to submitting performance requirements, the client 31 may specify an evaluation

2   algorithm for evaluating bids. For example, the client 31 may specify that cost is to be weighted

3   twice as much as any other performance requirement.

4   In the absence of a client-specified evaluation algorithm, the bidding service 90 may apply

5   a standard evaluation algorithm in order to rank bids for each branch in the work flow. The

6   evaluation algorithm may apply weighting criteria, or may apply a default rule. For example, bids

7   may be ranked based on a maximum score, where points are awarded for cost estimates below

8   a maximum and for completion times below a maximum. Once the evaluation algorithm has been

9   applied, the bidding service 90 ranks the bids for each branch. If only one processor 80 survives

10   the process, that processor 80 may be automatically selected and assigned to the branch. If

11   multiple processors 80_i survive, the bidding service 90 may provide a list of such processors 80_i

12   to the work flow controller 70, which will then select the processors 80_i to be assigned to the

13   branches. Alternatively, the list may be provided to the client 31, and the client 31 may select the

14   processor(s) 80_i to complete the tasks defined in the work flow.

15   The work flow controller 70 may associate winning bids with corresponding branches, and

16   may store the bid information with the job ticket 61. The stored bid information may include

17   identification information that allows the authorization server 94 and the authentication server 92

18   to permit access to job ticket branches or to the entire job ticket 61. Because the bid information

19   is stored with the job ticket 61, a processor 80 may access those branches for which the processor

20   80 is authorized access without having to communicate directly with the job ticket service 61. This

21   feature allows the job ticket 60 to be passed from one processor 80 to another processor 80,

22   which improves processing time and efficiency.

23   In an embodiment, the work flow controller 70 accesses control data of the job ticket 61

24   to determine which processor(s) 80_i should be assigned to the specific task identified in the job

25   ticket. The work flow controller 70 may also identify which of the processors 80_i would be able

26   to meet the criteria specified in the control data, and may provide a list of such processors 80_i to

27   the client through the front end service 30. The client 31 may then select a processor(s) 80_i from

28   the list.

29   The job ticket service may, in an alternative embodiment, be implemented in whole or in

30   part by storing program instructions on a computer-readable medium, such as a CD-ROM, for

1   example. A computer processor may then implement method steps to provide the job ticket

2   service by reading and executing the program instructions.

3   Figure 5A illustrates an exemplary job ticket 61. The job ticket 61 may include two parts.

4   A first part includes a framework 62 and an optional client extension 64. The framework 62

5   includes information, files and programming necessary to control tasks defined in the job ticket 61.

6   The client extension 64 may include information related to a specific client (machine) and to a user

7   of the machine. A second part includes a security module 67 that protects the job ticket 61 from

8   unauthorized access.

9   The framework 62 may include a job identification (ID) 63, a service ID 65, a task section

10   68, and control data 69. The job ID 63 includes a reference to a specific job, or content 51 that

11   is stored in the job store 50. The job ID 63 also includes a reference to a particular job store 50

12   that is used to store the content 51. An entity that acquires a reference to the job ticket 61 can use

13   the job ID 63 to access the corresponding content 51. Thus, the network 20 shown in Figure 3

14   may include multiple job stores 50, and the job ID 63 may be used to correlate the job ticket 61

15   to a specific job store 50. The service ID 65 identifies a specific job ticket service 60 that stores

16   the job ticket 61. For example, the network 20 may include multiple job ticket services 60 (not

17   shown in Figure 3). The service ID 65 is used to correlate the job ticket 61 to the appropriate job

18   ticket service 60.

19   The tasks section 68 (Figure 5B) may include branch definitions, and other information

20   needed to control completion of the branches. The tasks section 68 may be structural so that each

21   branch or node in a node tree is represented by one or more branches 66_i in the tasks section 68.

22   In this embodiment, each node in the node tree (e.g., the mode tree 10 of Figure 2) can have

23   associated with the node, the description 95, resources 96, lock/unlock flag 97, and security

24   features 99. In this way, the job ticket 61 reflects a hierarchical database structure. The control

25   data 69 includes the specific instructions, parameters, and criteria for completing the task identified

26   by the job ticket 61. The control data 69 may also include specific data required to complete tasks

27   defined in the job ticket 61. The control data 69 may also be associated with each node in a node

28   tree.

1   The security module 67 controls access to a specific job ticket. The security module 67

2   may be implemented using standard encryption and access techniques, including public/private key

3   infrastructures, for example.

4   The client extension 64 may contain "custom" information, such as user age, credit card

5   number and zip code. Information provided in the client extension 64 may be protected by use of

6   a public key signature, or similar feature. Hence, all client extension information will automatically

7   be included in a Message Digest Protocol (MDP) and will affect the signature of the job ticket 61.

8   With the above-describe job ticket architecture, many Internet-related security issues are

9   addressed, including IP spoofing, time controlled sessions, job ticket alterations, varying

10   authorization levels, and client-dependent persistent data storing.

11   The job ticket 61 shown in Figure 5A may be used to refer to a specific content 51 in the

12   job store 50. Alternatively, multiple job tickets 61 may be used to refer a specific content 51, or

13   one job ticket 61 may be used to refer to multiple contents 51. Thus, for example, one job ticket

14   61 may specify a repetitive printing task to be completed on similar documents, each of which has

15   a different content 51.

16   Using the network 20 shown in Figure 3, and the corresponding job ticket shown in Figure

17   5A, a client 31 may request and have completed many different electronic services. For example,

18   the client 31 may use the network 20 as an e-mail application.

19   Figure 5B shows the tasks section 68 in detail. The tasks section 68 may include one or

20   more branch descriptors 66 that include information related to processing for that branch. A

21   description segment 95 may define the tasks to be completed for each branch. Alternatively, the

22   description segment 95 may provide a link, or handle, to a file that contains the branch description.

23   The resources segment 96 lists input and output resources associated with the tasks defined for the

24   branch. The lock/unlock flag segment 97 allows a flag to be set to lock and unlock a branch. A

25   bid information segment 98 includes bid information gathered, for example, by the bidding service

26   90. The bid information 98 may include detailed information such as the IP address of the

27   processors authorized access to the branch, estimated performance information (e.g., estimated

28   cost, delivery time), and other information. Alternatively, the bid information 98 may contain a link

29   to another file containing the detailed bid information. The security segment 99 may indicate

30   authorized security levels, and may be used as part of a public key/private key infrastructure.

1   Figure 5C illustrates an embodiment of the control data 69. The control data 69 includes

2 a client address, which may be a machine address, such as an Internet protocol (IP) address. An

3 expiration date/time segment may be used to terminate active status of the ticket 61. Once

4 terminated, the ticket may be deleted from the job ticket service, and the corresponding content

5 51 may be de-referenced. That is, the contents may no longer be referenced by a specific job

6 ticket 61. This feature may help eliminate stale data, and free up resources for other job requests

7 32 (see Figure 7). Finally, the control data 69 may include specific performance requirements, such

8 as cost an delivery, warranty, required materials, price reductions based on quantity, and other

9 requirements, for example.

10   The use of job tickets as XML objects allows clients to define databases, and to store data

11 through the job ticket service 60 and the job store 50. The databases may be used to hold contact

12 lists, addresses, and other personal data. The databases may also be used to store any other

13 generic data. The databases could then be used in conjunction with a variety of e-services

14 provided by the processors 80_i. For example, an e-mail processor 80 that provides e-mail services

15 may be used in conjunction with a personal contact list to send e-mail messages, transfer electronic

16 files, or to establish a chat room. The e-mail processor 80 may access the contact list at predefined

17 intervals to send e-mail messages to a select group of e-mail addressees. Furthermore, because

18 the service center 40 provides a single portal to processors 80 that are coupled to the

19 communications network 35, the client 31 need not have any knowledge of the database structure,

20 or the processing requirements of the processors 80.

21   In the specific application of the generic XML database to an e-mail service, the client 31

22 may have established, as a generic database, a list of e-mail contacts. The contacts database may

23 then be stored in the job store 50 as a content file 51. A corresponding job ticket 61 may be

24 stored at the job ticket service 61. The job ticket 61 includes control data needed to send and

25 receive e-mail through the service center 40. Furthermore, the job ticket 61 serves as a pointer

26 to data in the content file 51. In particular, the job ticket 61 may store XML data that is related

27 to other data stored in the content file 51.

28   Alternatively, the job ticket 61 may store the contacts data. This alternative takes

29 advantage of the fact that the job ticket 61 includes a vocabulary that can be extended to include

30 the contact data, and that the vocabulary can be further extended to include properties for each

1   contact in the contact data. For example, the job ticket 61 may specify that a contact is a business

2   contact or a personal contact. Other properties may also be included, such as whether the contacts

3   in the contact database use mobile phones, land line phones, facsimile machines, and e-mail

4   addresses.

5   The use of the job ticket 61 also allows for parsing, searching and updating the contacts

6   database. For example, the client 31 may desire to search the contacts database for phone

7   numbers for all persons whose first name is Joe. This search functionality is included in the job

8   ticket 61, and allows the job ticket service 60 to provide the client with a list of phone numbers for

9   all entries in the contacts database where the person's first name is Joe. That is, the contacts

10   database includes entries having the property of Joe, and the job ticket service is able to search the

11   contacts database for this property, and to return a list of those entries to the client 31.

12   The properties function of the job ticket 61 also allows the job ticket service 60 to control

13   specific tasks desired by the client 31, or to indicate to the client that a desired task cannot be

14   completed. Staying with the example of the contacts database, the client 31 may desire to send

15   a facsimile transmission to all entries in the contact list that have a specific zip code. The job ticket

16   service 60 can search the contacts database by properties, looking for zip code. The job ticket

17   service 60 can also search the contacts database to determine if any entry does not have a facsimile

18   machine. For those entries that do not have a facsimile machine, the job ticket service 60 can

19   originate a message to send back to the client 31, informing the client 31 that the facsimile

20   transmission was undeliverable. Using this functionality, the client 31 need not know anything about

21   the intended recipients of the facsimile transmission.

22   Returning to the example of an e-mail service, at the client 31, an e-mail application may

23   be launched in order to send an e-mail message, using the Internet, to one or more contacts in the

24   contact database. However, the client 31 need not subscribe to any one Internet service provider.

25   Instead, the service center 40 determines which processor 80 best suits the client's needs for

26   sending the e-mail message. That is, the service center 40 may select a e-mail service provider (a

27   processor 80) to send the e-mail message to a chosen destination address. Furthermore, the

28   service center 40 may determine, based on information maintained in the contact database (i.e., the

29   content 51 in the job store 50), which delivery options are desired by a user at the destination

30   address. For example, the destination address user may desire that all e-mail messages be sent to

1 an e-mail box, or that an alert be provided whenever an e-mail message is sent. These delivery

2 features may be stored in the contact database in the job ticket 61. Alternatively, the delivery

3 features may be stored in a separate database (content file 51) in the job store 50, and the service

4 center may retrieve information form this separate database when determining how to deliver the

5 e-mail message. Specifically, the separate database may include a variety of users, along with the

6 user's Internet address. By comparing the Internet address provided with the out going e-mail to

7 the Internet addresses in the separate database, the service center 40 can determine desired

8 delivery options of the addressee. This process for determining delivery options is transparent to

9 the client 31 that originated the e-mail message. All that the client 31 need know is the contact

10 information (e.g., the Internet address or a contact name).

11 The client 31 may use the job ticket service 60 to specify a number of performance features

12 related to the e-mail service. For example, the client 31 may want the service center 40 to attempt

13 a specified number of delivery attempts, and if delivery does not occur, to send a return message

14 to the client 31 indicating non-delivery of the e-mail message.

15 In another application , the service center 40 may operate as a focal point for a client's

16 messaging systems. The service center may receive and store messages in the job store 50, or

17 within a job ticket 61. Preferably, a separate content file 51 or job ticket 61 is established for each

18 client 31 having an account on the service center 40 so that all of the messages for a single client

19 31 will be stored in the same directory.

20 The network 20 shown in Figure 4 may include the necessary communications interfaces

21 to support voice, e-mail, and facsimile transmissions. When a call arrives at the service center 40,

22 a central processor (not shown in Figure 4) may read an incoming address signal from the

23 originating user, and use the address to store the message in the appropriate job ticket 61.

24 In addition to handling incoming calls and storing the messages, the service center may

25 coordinate a response from the client 31. For example, the client may request a specific response

26 (e.g., and out of office notice) to an e-mail message from a user. The responses may be stored as

27 part of the client's content file 51. The job ticket service 60 may access the content file 51, and

28 download an appropriate response message. The job ticket service 60 may then use a processor

29 80 to deliver the response back to the originating user.

1   The job ticket service 60 may also include software to transform incoming messages (voice,

2 facsimile) into XML files for storage in the content file 51.

3   The job ticket 61 or the content file 51 may contain the data indicating the preferences of

4 the client 31. Thus, for example, when a facsimile message in the TIFF/F format is retrieved by the

5 service center 40, the job ticket service 60 may ascertain from the data in job ticket 61 the

6 preferred option of displaying the facsimile message and would generate the appropriate HTML

7 files.

8   The service center 40 may be connected to a paging system processor 80. Upon the

9 arrival of a new message, in addition to sending an e-mail message to the client's mailbox, the

10 service center 40 may also activate the paging system processor 80 so that a pager (not shown)

11 would be activated. In this manner, the client 31 could receive almost instantaneous notification that

12 a message has arrived.

13   The service center 40 may use the data in the job ticket 61 to provide other information

14 and alerts to the client. For example, the service center 40 may send a message to the client to

15 indicate upcoming appointments, and special dates, such as birthdays. The client 31 may designate

16 in the control data section of the job ticket 61 that birthday greeting be automatically sent to specific

17 individuals whose information is stored in the job ticket 61.

18   The service center 40, when supporting client communications, may operate according an

19 asynchronous manner. In an asynchronous mode of operation, information requested by the client

20 31 may not be available and may have to be generated after the job request 32. The asynchronous

21 mode of operation is preferred since fewer files are generated, thereby reducing the required

22 amount of storage. Because the information requested by a client 31 may not be available, some

23 anchors cannot specify the filename, such as "2.html," but will instead contain a command for the

24 file. For instance, an anchor may be defined as<AHREF=/faxweb/clients/2496801/

25 viewpage.cgi?FAX.sub.-- NUM=1&PAGE=1&VIEW.sub.-- MODE=FULL> for causing a CGI

26 to run a viewpage program so that page 1 of facsimile message 1 will be displayed in a full size

27 image. The CGI will generate the requested information when the information has not been

28 generated, otherwise the CGI will retrieve the information and relay the information for transmission

29 to the client 31.

30   The service center 40 can reliably receive voice, facsimile, and data messages for a plurality

1   of clients 31 and can receive more than one message for a client 31 at a single time. The messages

2   are stored by the service center 40 and can be retrieved at the client's convenience at any time by

3   connecting to the service center 40.

4   This use of the service center 40 provides a great number of benefits. The client 31 would

5   not need a facsimile machine, voice mail system, or a machine dedicated for receiving data

6   messages. The client 31 also need not worry about losing part of the message or violating the

7   confidential nature of the messages. The client 31, of course, can still have a facsimile machine and

8   dedicated computer for data messages. The service center 40, however, will permit the client 31

9   to use the telephone company's call forwarding feature so that messages may be transferred to the

10   service center 40 at the client's convenience, such as when the client 31 is away from the office.

11   Furthermore, the client 31 may be provided with a greater or fewer number of options in

12   displaying or retrieving messages. The options may permit the client 31 to review or retrieve the

13   messages in other formats. The options may also permit a client 31 to join two or messages into

14   a single message, to delete portions of a message, or to otherwise alter the contents of the

15   messages.

16   The service center 40 may restrict a client 31 to only certain types of messages. For

17   example, a client 31 may want the service center 40 to store only facsimile messages in order to

18   reduce costs of using the service center 40. In such a situation, the service center 40 would

19   perform an additional step of checking that the type of message received for a client 31 is a type

20   of message that the service center 40 is authorized to receive on the client's behalf. When the

21   message is an unauthorized type of message, the service center 40 may ignore the message entirely

22   or the service center 40 may inform the client 31 that a user attempted to send a message to the

23   service center 40.

24   The service center 40 has been described as converting the messages into XML and

25   transmitting the XML files to the client 31. The XML format, however, is only one format for

26   exchanging information on the Internet and is actually only one type of a Standard Generalized

27   Mark-Up Language. The service center 40 is therefore not limited to the XML format but may be

28   practiced with any type of mixed media page layout language that can be used to exchange

29   information on the Internet.

30   According to an embodiment, the service center 40 may be used as a file repository serving

1   as an archive for a particular client 31 or group of clients 31. As described above, the service

2   center 40 may maintain a list of all messages for a particular client 31, which is displayed to the

3   client 31 when the client 31 accesses a mailbox. The service center 40 may store all messages,

4   whether they are voice, facsimile, or data, for a client 31 in the database indefinitely. The service

5   center 40 may therefore be relied upon by a client 31 to establish the authenticity of a message and

6   the existence or absence of a particular message. Through the service center 40, a client 31 can

7   therefore maintain an accurate record of all received email messages, facsimile messages, and data

8   transfers.

9   In addition to serving as a file depository, the service center 40 may also function as a

10   document management tool. When the service center 40 receives a message, the service center

11   40 updates a database (content file 51) with information on the message. This information includes

12   the type of message, whether it is a facsimile message, voice message, or data message, the time

13   and date at which the message was received, the size of the file, such as in bytes, the telephone

14   number of the caller leaving the message, as well as other information, such as the number of pages

15   of a facsimile message. Because the address (e.g., a telephone number or e-mail address) called

16   is unique for each client 31, the information also includes the intended recipient of the message.

17   As noted above, the job ticket 61, in conjunction with other components of the service

18   center 40, may also be used to create a persistent, generic object-based data structure, such as an

19   XML database. An example of the use of a job ticket 61 for this purpose is illustrated in Figure

20   5D. The job ticket 61 includes a contacts list 84, which may be in the form of an XML database,

21   or some other generic database. The contacts list 84 may include a structure with entries for

22   business 85 and personal 86 use. The business 85 and personal 86 contacts structures may include

23   entries of individuals 87, as shown. Each of the entries 87 may include specific properties, as

24   defined above. In addition, or alternatively, each of the entries 87 may include links to other

25   databases that provide additional information and properties about the individual.

26   While the use of the job ticket 61 as a XML database has generally been described with

27   reference to an e-mail and messaging service, the job ticket 61 is not so limited. Any data that is

28   capable of being stored in a database may be accesses and controlled using the job ticket 61.

29   The features described above, and shown in Figures 5A-5D may be replicated in another

30   embodiment of a job ticket 61 in which all data related to a specific node or branch is located with

1   that node or branch. Using the example node-tree 10 shown in Figure 2, each node (branch) may

2   include detailed information, and features such as resources, authorized processors 80_i,

3   lock/unlocked flag, bid information, branch description, and other information.

4   Figure 6 is a diagram of functions of the job ticket service 60. The primary functions of the

5   job ticket service 60 are to store 73 the job tickets 61_i and to provide access 75 to the job tickets

6   61_i to users such as the client 31 and to the processors 80_i. To accomplish these storage and

7   access functions, the job ticket service 60 may create a job ticket reference 72 and a job resource

8   reference 74. The job ticket service 60 also controls job content access 76, updates 77 the job

9   tickets 61_i as processes are completed and reported by the processors 80_i, completes the job

10 tickets 61_i and reports 78 when all processes are completed for a specific job ticket 61, and

11 provides an approval process 79 to allow a client 31 to approve completion of the tasks designated

12 in the job ticket 61.

13   The job ticket reference 72 includes a specific reference to a corresponding job ticket 61_i.

14 The job ticket reference 72 may be used by the job ticket service 60 to allow one or processors

15 80_i and clients 31_i to access the job ticket 61. That is, instead of passing the job ticket 61 to a

16 processor 80, the job ticket service 60 passes the job ticket reference 72. With the job ticket

17 reference 72, the processor 80 may access all or a part of a job ticket 61 so that the processor 80

18 may complete one or more processes. Unlike conventional job ticket services, the job ticket

19 service 60 retains the job ticket in storage 73, and only permits users (clients 31 and processors

20 80) to access the job ticket 61. This feature allows multiple processors 80 to simultaneously

21 complete processes for the specific job request 32 related to the job ticket 61.

22   The job ticket service 60 may also create a resources reference 74, and may provide the

23 resources reference 74 to the processors 80 and the clients 31 in a manner similar to that of the job

24 ticket reference 72. As noted above with the description accompanying Figure 2, the resources

25 may include physical devices and materials, and may include digital files. Use of the resources

26 reference 74 may simplify data included in the job ticket 61.

27   Alternatively, information contained in the resources reference 74 may be included in the

28 job ticket 61, or may be included in other files accessed by the clients 31_i and the processors 80_i.

29   Figure 7 is a diagram showing operation of selected functions of the job ticket service 60.

30 As shown in Figure 7, the job ticket service 60 includes a job ticket 61_1, which may be a

1   programming object such as that represented in Figure 2, and described above. The job ticket 61_1

2   is shown supplied to the job ticket service 60 by the client 31_1. The client 31_1 may be a networked

3   computer or similar device that is capable of transmitting the digital information representing the job

4   ticket 61_1 to the job ticket service 60. To ensure the job ticket 61_i arrives at the job ticket service

5   60, the job ticket 61_1 may contain a reference to the job ticket service 60, such as the service ID

6   65 illustrated in Figure 5A. The service ID 65 may include a network address of the job ticket

7   service 60. For example, the service ID 65 may include a universal resource locator (URL) if the

8   job ticket service 60 is an Internet web site.

9   Also shown in Figure 7 are client 31_2 and processors $80_1 - 80_N$. The processors $80_1 - 80_N$

10   may include networked resources such as networked printers, electronic-commerce entities, such

11   as Internet web sites, and "brick and mortar" entities, such local print shops that are coupled to the

12   job ticket service 60 using the service bus 41.

13   The client 31 generates a job request 32 (content 51 and job ticket data). Using the front

14   end service 30 (not shown in Figure 7) and the service bus 41, the client 31_1 sends the job ticket

15   data to the job ticket service 60 and the content 51 (not shown in Figure 7) to the job store 50.

16   The job ticket service 60 may pass the job ticket data to the work flow controller 70, which will

17   create a job ticket 61. The content 51_1 and the job ticket 61_1 are related by the job ID 63. The

18   job ID 63 also includes an identification of the job store 50, and a location within the job store 50

19   in which the content 51_1 is stored. In an alternate embodiment, the content 51_1 may be stored at

20   the client 31_1, and may then be accessed by other users through the service bus 41 and the front

21   end service 30.

22   The job ticket 61_1 specifies processes that must be completed to finish the job request 32.

23   As noted above, Figure 2 illustrates processes required to print a brochure, including the inside

24   pages and the cover. More that one processor 80_i may be required to complete such a job

25   request, or to complete the job request in the most cost-efficient and/or timely manner. The work

26   flow controller 70 (not shown in Figure 7) can determine which of the processors 80_1-80_N should

27   complete a specific process, and, if necessary, the order in which such processes should be

28   completed. The work flow controller 70 may poll the various processors 80_i to determine which

29   may be used to complete the job request. The work flow controller 70 may then notify selected

30   processors 80_i that a job request has been registered with the job ticket service 60.

1   For each job ticket 61_i received, the job ticket service 60 creates a reference 72_i to the

2   job ticket 61_i. The processor 80_1 may request access to the job ticket 61 in order to complete one

3   or more processes. In response, the job ticket service 60 provides the processor 80_1 with the job

4   ticket reference 72_1. The job ticket reference 72_1 is then used as an index to the job ticket 61_1.

5   The job ticket reference 72_1 may also be provided to other processors, such as the processor 80_2,

6   and to other clients, such as the client 31_2. The processor 80_2 and the client 31_2 may then access

7   the job ticket 61_1 at the same time as the processor 80_1 accesses the job ticket 61_1. This

8   simultaneous access allows different processes to be completed in parallel. In the example

9   illustrated in Figure 2, the processor 80_1 may complete some or all the processes for the inside

10   pages, and the processor 80_2 may complete the processes for the cover.

11   Figure 8 is a block diagram illustrating an example application of the control features of the

12   job ticket service 60. The job ticket 61_1 is referenced to the job content 51_1 by the job ticket ID

13   63, and information related to the job ticket 61_1 and the job content 51_1 is passed over the service

14   bus 41. The processors 80_i can access the job content 51_1 and the job ticket 61_1 using the service

15   bus 41. In the illustrated example, the job ticket 61_1 refers to a job request 32 to print a brochure

16   using the processes outlined in Figure 2. The processor 80_1 is designated by the work flow

17   processor 70 to produce the inside pages of the brochure and the processor 80_2 is designated to

18   produce the brochure cover. The processor 80_1 passes a job ticket access request to the job

19   ticket service 60. The access request may include security information that allows the processor

20   80_1 to access the job ticket 61_1 and the corresponding content 51_1 or job. In response, the job

21   ticket service 60 provides a job ticket reference 62_1 that is used by the processor 80_1 to access

22   the job ticket 61_1. The processor 80_1 may use information in the job ticket 61_1 to access the

23   content 51_1 stored in the job store 50. Since the processor 80_1 will produce only the inside pages,

24   the processor 80_1 will not need access to all the information contained in the job ticket 61_1.

25   Furthermore, because the job ticket 61_1 remains in the job ticket service 60, other entities, such

26   as the processor 80_2, may continue to access the job ticket.

27   As the processor 80_1 completes various processes, the processor 80_1 may update the

28   content 51_1 and the job ticket 61_1. Thus, the job ticket 61_1 may reflect the latest status of the job

29   request 32. The status reports may indicate when a node in the node tree 10 is completed, when

30   an interim deadline is completed, when another processor may be used to complete a process, and

1   when all processing is complete. The status report may be included in a digital file that is used by

2   the work flow controller 70, for example. The status report may also be included in a human-

3   readable format, such as a pop-up window on a computer display screen. The processor 80_1 may

4   receive the job ticket reference 72_1, and may complete all scheduled processes, returning the job

5   ticket reference 72_1 to the job ticket service 60. The processor 80_1 may also send a copy of the

6   job ticket reference 72_1 to the processor 80_2, so that the processor 80_2 may access the job ticket

7   61_1, and the content 51_1 and produce the brochure cover.

8   Figure 9 is a flowchart illustrating an operation 100 of the job ticket service 60. The

9   operation 100 is based on completing the inside pages nodes shown in Figure 2. The operation

10   100 may be at least partly under the control of the work flow controller 70, or some equivalent

11   device. The operation 100 assumes that a job request 32 (job ticket data and content) have been

12   passed to the service center 40, and that a job ticket service 60 has been created. The operation

13   100 begins at start block 101. In review and assign processors block 105, the work flow

14   controller 70 determines which processors 80_i are able and available to complete the job. The

15   work flow controller 70, or the optional bidding service 90 may use polling or bidding features to

16   make the determination. If more than one processor 80_i is available, and can satisfy the

17   requirements of the job ticket 61, the work flow controller 70 may assign one specific processor

18   80 to the job. Alternatively, the work flow controller 70 may provide a list of processors 80_i to

19   the client 31, and allow the client 31 to select one or more processors 80_i.

20   In request job ticket block 110, a processor 80, having been authorized access to a job

21   ticket 61, sends an access request to the job ticket service 60 using the service bus 41. In block

22   115, the job ticket service verifies that the processor 80 may access the job ticket 61. Access may

23   be controlled by a password, an identification, and a public key/private key security system, for

24   example. In block 115, if the processor 80 is denied access, an error signal may be sent to the

25   processor and/or the client 31, block 120.

26   In block 115, if access is authorized, the job ticket service 60 provides the processor 80

27   with a copy of the job ticket reference 72 corresponding to the job ticket 61, block 125. The job

28   ticket reference 72 allows the processor 80 to access the job ticket at any time. By accessing the

29   job ticket 61 at any time, the processor 80 is able to view an updated version of the job ticket 61

30   as changes are made to the job ticket 61 by other entities, including other processors 80.

1   In block 130, the job store 50 provides access to the job content 51 that is referenced by

2   the job ticket 61. Only that part of the content 51 that may be needed by the processor 80 may

3   be supplied by the job store 50. For example, if the processor 80 is only to generate the inside

4   pages of the brochure, the job store 50 may not provide access to the content required to produce

5   the brochure cover. After receiving the job ticket reference 72 and the content 51, the processor

6   80 may perform one or more tasks using input resources to produce an interim or final output

7   resource. With completion of each node in the node tree 10, the processor 80 may provide an

8   input to the job ticket service 60 to allow modification of the job ticket 61, block 135. If the

9   processor 80 completes all required processes, the processor 80 may provide a final status report

10   to the job ticket service 60, block 140, along with any final modifications to the job ticket 61.

11   In block 145, the job ticket service 60 and the work flow controller 70 determine if any

12   additional tasking may be required. If additional tasks are required, the work flow controller 70

13   will ensure the appropriate processors 80 are assigned, and the operation returns to block 110.

14   If no additional processes are required, the operation moves to block 150 and ends.

15   Figure 10 is a flowchart illustrating the routine 105 for developing a work flow and assigning

16   processors to the work flow. The process starts in block 200. In block 205, the service center

17   40 receives a job request 32. The job request 32 may specify performance requirements,

18   resources, and other parameters, and may include content 51, or a link to the content 51. In block

19   210, the work flow controller 70 defines a work flow to accomplish the tasks specified in the job

20   request 32. The work flow may be represented by a node tree, such as the node tree 10 shown

21   in Figure 2.

22   In block 230, the work flow controller 70 generates a job ticket 61 using the information

23   provided by the job request 32, the work flow generated in block 210, and an appropriate job

24   ticket template. The job ticket 61 is then stored in the job ticket service 60. Any content 51 may

25   be stored in the job store 50.

26   The work flow controller 70 or the job ticket service 60 may create a job ticket notice, or

27   other object, and may post the notice, block 250, at the service center 40 so that outside entities

28   (e.g., the processors 80) may acquire sufficient information to bid on completion of the job ticket

29   61, or a branch 66 of the job ticket 61. In an alternative embodiment, the job ticket 61 may be

30   posted at the service center 40. If the job ticket 61 is posted, the job ticket 61 may include

1   mechanism to limit access to the job ticket or to limit access to certain portions of the job ticket 61.

2   For example, the client extension 64 may not be accessible to the processors 80.

3   In block 270, the service center 40 receives bids from specific processors 80 and in block

4   290, the service center 40 evaluates the bids. In block 295, the service center 40 determines if the

5   client 31 submitting the job request 32 intends to select the winning bid(s), or if the service center

6   40 makes the selection. If the client is to make the selections, in block 300, the service center 40

7   provides the bid information to the client 31. Then, in block 305, the service center 40 receives

8   the selections from the client 31. If the service center 40 is to make the selections, in block 310,

9   the service center 40 selects the winning bid(s). In block 315, the service center notifies the

10   winning processors. The service center may also store the bid information with the corresponding

11   job ticket 61. In block 320, the routine 105 ends.

12   Figure 11 is a flowchart illustrating the sub-routine 210 for defining a work flow. The sub-

13   routine 210 starts in block 350. In block 355, the work flow controller 70 determines if the work

14   flow will contain multiple branches. If the work flow will contain multiple branches, the work flow

15   controller 70 defines the branches, block 360. In block 365, the work flow controller 70 selects

16   a branch for which resources and processes are to be defined. In block 370, the work flow

17   controller 70 defines input resources for a first process, or node. In block 375, the work flow

18   controller 70 defines the tasks to be completed for the first process. In block 380, the work flow

19   controller 70 determines the output resources of the first process. In block 385, the work flow

20   controller 70 determines if another process is required for the work flow or branch. In no

21   additional processes are required, the work flow controller 70 determines if another branch is to

22   be defined, block 390. If another branch is to be defined, the work flow controller 70 selects

23   another branch, block 365, and the sub-routine 210 continues. If another branch is not to be

24   defined, the sub-routine 210 ends, block 395. The results of the work flow definition may be

25   incorporated into the job ticket 61 (see Figure 10, block 230).

26   Figure 12 is a flow chart illustrating the sub-routine 250 of posting a job ticket notice or job

27   ticket. The sub-routine 250 starts in block 400. In block 405, the work flow controller 70

28   determines if the work flow associated with the job ticket 61 includes multiple branches. If the

29   work flow does not include multiple branches, the work flow controller posts the job ticket notice

30   listing the single branch, block 410. If the work flow includes multiple branches, the work flow

1   controller 70 posts the job ticket notice with multiple branches, block 420. The sub-routine 250

2   then ends.

3   Figure 13 is a flow chart illustrating the sub-routine 290 for evaluating bids. The sub-

4   routine starts in block 440. In block 445, the bidding service 90 selects a first bid for analysis. In

5   block 450, the bidding service 90 determines if the client 31 has supplied any evaluation criteria or

6   requirements. If the client has not supplied evaluation requirements, the bidding service 90

7   compares the selected bid to a set of standard, minimum performance requirements, which may be

8   industry-standard requirements, block 455. In block 460, the bidding service 90 determines if the

9   bid meets the minimum performance requirements. If the bid does not meet the minimum

10 performance requirements, the bid is rejected, block 475. If the bid is rejected, the bidding service

11 90 determines if additional bids were submitted, block 495. If additional bids were submitted, the

12 bidding processor 90 returns to block 445 and selects the next bid for evaluation.

13   If in block 450, the client 31 has supplied performance requirements, the bidding service

14 90 compares the selected bid to the client-supplied performance requirements, block 465. In

15 block 470, the bidding service 90 determines if the selected bid meets the minimum criteria of the

16 client-supplied performance requirements. If the minimum criteria are not met, the bidding service

17 90 rejects the bid, block 475.

18   In blocks 470 and 460, if the minimum criteria are met, the bidding service 90 determines

19 if the client 31 has supplied an evaluation algorithm. If the client 31 has not supplied an evaluation

20 algorithm, the bidding service applies a standard evaluation algorithm, which may be an industry-

21 standard algorithm, block 485. If the client has supplied an evaluation algorithm, the bidding service

22 90 applies the client-supplied evaluation algorithm, block 490. The bidding service 90 may then

23 store the results of the algorithm pending evaluation of all bids.

24   In block 495, the bidding service 90 determines if any bids remain to be evaluated. If

25 additional bids remain, the sub-routine 290 returns to block 445, and the bidding service selects

26 the next bid for evaluation. In block 495, if no additional bids remain for evaluation, the bidding

27 service 90 ranks the bids, block 500. The sub-routine 290 then ends, block 505.

28   Figure 14 is a flowchart illustrating the routine 130 for providing access to a job ticket 61.

29 The routine 130 begins in block 510. In block 515, the job ticket service 60 receives a job ticket

30 reference 72 from a processor 80, and retrieves the corresponding job ticket 61, block 520.

1   In block 525, the job ticket service 60 compares the processor identification to processors

2   listed in the job ticket 61 or branches 66 of the job ticket 61. The job ticket service 60 determines

3   if the selected branches 66 are locked, block 530. If the selected branches 66 are not locked, the

4   job ticket service 60 copies the selected branches 66 to the processor 80, block 535. In block

5   550, the job ticket service 60 then determines if the selected branches 66 require locking. If the

6   selected branches do not require locking, the routine 130 ends, block 560. If the selected branches

7   66 require locking, the job ticket service 60 locks the selected branches 66, block 555. The

8   routine 130 then ends, block 560.

9   In block 530, if the selected branches 66 are locked, the job ticket service 60 determines

10   if the processor 80 intends to modify information in the selected branches 66, block 540. If the

11   processor 80 will not modify the selected branches 66, the job ticket service 60 may provide an

12   error message, block 545. If the selected branches 66 will be modified, the job ticket service 60

13   may unlock the selected branches 66, block 547.

14   Figure 15 is a flow diagram of a method for allowing access to a job ticket 61. The method

15   may execute as part of the routine 115 shown in Figure 9. The method starts with block 600. In

16   block 605, the authentication server 94 receives authentication information from a processor 80

17   and retrieves a job ticket 61 corresponding to a job ticket reference 72 possessed by the processor

18   80. At this stage of the process, the job ticket 61 (excluding the public key signature field 67)

19   contains two information fields, the framework 62 and the client extension 64. The framework 62

20   contains information such as the service ID, client IP address, expiration date and time, and

21   processor authorization, as previously described. The client extension 64 contains information such

22   as credit card number and zip code, also previously described. The information in the job ticket

23   61 (excluding the public key signature field 67) is then, for example, optionally hashed using, for

24   example, MD5 protocol, and encrypted with a public key encryption system, block 610, generating

25   a hash number, block 615. Other hashing or encryption techniques may also be used. The hash

26   number is representative of the specific information contained in the job ticket 61. The hash number

27   generated in block 615 is then encrypted using a standard public key encryption system, block 620.

28   Encrypting the hash number with a private key prevents any user without knowledge of the public

29   key from modifying the job information. In block 625, the job ticket 61 and the encrypted hash

30   number are concatenated to generate the completed job ticket 61. Hence, the completed job ticket

1   61 information fields: 1) the framework 62, 2) the client extension 64, and 3) the public key

2   signature (encrypted hash number) 67. The method then ends, block 630.

3   Figure 16 illustrates a process 700 for using the service center 40 for document

4   management purposes, with reference to Figure 4. The process starts in block 705. A client 31

5   sends a search request to the service center 40 for a particular document or set of documents,

6   block 710. The client 31 may issue this request with the job request 32 by clicking on a link, such

7   as a link to "Search Documents," which may be presented to the client 31 by the service center 40

8   after the client 31 has been granted accesses to the client's mailbox. The service center 40 may

9   present the client 31 with the option to search the document archives at other times, such as when

10   the client 31 first attempts to access the mailbox, or when the URL received by the service center

11   40 points toward the document archives.

12   In response to this request, the service center 40 sends the client 31 a search query form

13   at block 715 to allow the client 31 to define a desired search. The search query form may include

14   an entry for each of the data fields in the content file 51. For example, the client 31 may input one

15   or more names for a recipient and have the service center 40 search for all messages or files

16   directed to just those recipients. The client 31 may also indicate the type of document, such as

17   whether it is a facsimile, voice message or data file. The search query form also has entries for the

18   date or time, which preferably accept ranges of times and dates, and an entry for the telephone

19   number of the caller to the service center 40. The search query form may also include an entry for

20   the size of the file or for the number of pages, which is relevant if the message is a facsimile

21   message. The search query form may also include an entry for the document number, which may

22   accept a range of document numbers, and also an entry for another field.

23   At block 720, the client 31 enters the search parameters in the search query form and

24   returns the information to the service center 40. The client 31 may define the search about any one

25   data field or may define the search about a combination of two or more data fields. For example

26   the client 31 may define a search by designating the document type as a facsimile and the calling

27   number as (XXX) 249-6801. Once the client 31 has finished defining the search, the client 31 then

28   selects the "SEARCH" link shown at the bottom of the screen whereby the client would send the

29   completed search query form to the service center 40.

30   At block 725, the service center receives the completed search query form and, through

1   a CGI, invokes one or more of the application programs 31 for performing the desired search for

2   any files or messages falling within the parameters of the search. The results of the search are

3   passed from the service center 40 through the CGI, at block 730, and returned to the client 31.

4   The service center 40 may return the search results in the form of a listing of all files or messages

5   contained within the search parameters.

6   At block 735, the client 31 selects the desired file or message from the listing of messages

7   and files. For example, by clicking on the first listed document, the client 31 sends a request to the

8   service center 40 for a viewing of that document and, in response, the service center 40 provides

9   a viewing of the document according to the defined preferences of the client 31. The client 31 may

10   receive a reduced size image of the first page, a full size image of the first page, reduced size images

11   of all pages, or full size images of all pages of the facsimile message.

12   At block 735, the client 31 may also have the service center 40 save the search results.

13   For example, the client 31 may input the name of JOE's FACSIMILES as the name for the search.

14   By clicking on a "SAVE SEARCH AS" link, the name of the search is provided from the client 31

15   to the service center 40. At the service center 40, the CGI invokes an application program 31 to

16   store the results of the search in the content file 51 under the designated name. The invoked

17   application program preferably does not store the contents of all messages but rather stores a listing

18   of the search results in the content file 51.

19   In the illustrated embodiments, the service center 40, and its sub-components, including the

20   work flow controller 70 and the job ticket service 60, for example, may be implemented as a single,

21   special purpose integrated circuit (e.g., an ASIC) having a main or central processor section for

22   overall, system-level control, and separate circuits dedicated to performing various different

23   computations, functions and other processes under control of the central processor section. Those

24   skilled in the art will appreciate that the service center 40 may also be implemented using a plurality

25   of separate, dedicated or programmable integrated or other electrical circuits or devices (e.g.,

26   hardwired electronic or logic circuits such as discrete element circuits, or programmable logic

27   devices such as PLDs, PLAs, or PALs). The service center 40 may also be implemented using

28   a suitably programmed general purpose computer, e.g., a microprocessor, microcontroller or other

29   processor device (CPU or MPU), either alone or in conjunction with one or more peripheral (e.g.,

30   integrated circuit) data and signal processing devices. In general, any device or assembly of

1   devices on which a finite state machine capable of implementing the flowcharts shown in Figures

2   9-16 can be used as the service center 40, or its sub-components.

3   The terms and descriptions used herein are set forth by way of illustration only and are not

4   meant as limitations. Those skilled in the art will recognize that many variations are possible within

5   the spirit and scope of the invention as defined in the following claims, and their equivalents, in

6   which all terms are to be understood in their broadest possible sense unless otherwise indicated.